105-A2

NUREG-1002
Supplement No. 3

COMPLETED

Safety Evaluation Report

related to the operation of
Braidwood Station,
Units 1 and 2

ORIGINAL

Docket Nos. 50-456 and 50-457

Commonwealth Edison Company

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

May 1987

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ABSTRACT

In November 1983, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-1002) regarding the application filed by the Commonwealth Edison Company, as applicant and owner, for a license to operate Braidwood Station, Units 1 and 2 (Docket Nos. 50-456 and 50-457). The first supplement to NUREG-1002 was issued in September 1986; the second supplement to NUREG-1002 was issued in October 1986. This third supplement to NUREG-1002 reports the status of certain items that remained unresolved at the time Supplement 2 was published. The facility is located in Reed Township, Will County, Illinois.

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1 INTRODUCTION AND GENERAL DESCRIPTION OF FACILITY

1.1 Introduction

In November 1983, the Nuclear Regulatory Commission (NRC) staff issued its Safety Evaluation Report (SER) (NUREG-1002) on the application filed by the Commonwealth Edison Company, as applicant and owner, for a license to operate Braidwood Station, Units 1 and 2 (Docket Nos. 50-456 and 50-457). At that time, the staff identified items that had not been resolved with the applicant. The first Supplement to NUREG-1002 was issued in September 1986; the second supplement to NUREG-1002 was issued in October 1986. The purpose of this third supplement to the SER is to provide the staff evaluation of the open items that have been resolved to date, to address changes to the SER which resulted from the receipt of additional information from the applicant, and to respond to the Atomic Safety and Licensing Board's requirements identified in its May 13, 1987 Partial Initial Decision on Emergency Planning Issues.

Each of the following sections or appendices is numbered the same as the corresponding SER section or appendix that is being updated. Each section is supplementary to and not in lieu of the discussion in the SER unless otherwise noted. Appendix A continues the chronology of the staff's actions related to the processing of the application for Braidwood Units 1 and 2. Appendix B lists references cited in this report.* Appendix F lists principal staff members who contributed to this supplement. Appendix I contains errata to the SER.

Copies of this SER supplement are available for inspection at the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C., and at the Wilmington Township Public Library, 201 South Kankakee Street, Wilmington, Illinois 60481.

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1.7 Summary of Outstanding Items

The current status of the outstanding items listed in the SER follows:

Part A Items	Status	Section
(1) Pump and valve operability	Closed in Supplement 2	3.9.3.2**

*Availability of all material cited is described on the inside front cover of this report.
**This section includes both site-specific-related information and duplicate plant design features.

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Part A Items (Continued)	Status	Section
(2) Seismic and dynamic qualification of equipment	Closed in Supplement 2	3.10*
(3) Environmental qualification of electrical and mechanical equipment	Closed in Supplement 2	3.11*
(4) Containment pressure boundary components	Closed in Supplement 1	6.2.7
(5) Organizational structure	Closed in Supplement 1	13.1, 13.4
(6) Emergency preparedness plans and facilities	Closed in Supplement 1	13.3*
(7) Procedures generation package (PGP)	Closed in Supplement 2	13.5.2
(8) Control room human factors review	Partially closed in Supplement 2	18.2*
(9) Safety parameter display system	Opened in Supplement 2	18.3*
(10) Control room habitability	Closed in this supplement	6.4
Part B Items		
(1) Turbine missile evaluation	Closed in Supplement 1	3.5.1.3
(2) Improved thermal design procedures	Closed in Supplement 1	4.4.1
(3) TMI Action Item II.F.2: Inadequate Core Cooling Instrumentation	Closed in Supplement 1	4.4.7
(4) Steam generator flow-induced vibrations	Closed in Supplement 1	5.4.2
(5) Conformance of ESF filter system to RG 1.52	Closed in Supplement 2	6.5.1
(6) Fire protection program	Closed in this supplement	9.5.1

*This section includes both site-specific-related information and duplicate plant design features.

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Part B Items (Continued)	Status	Section
(7) Volume reduction system	Closed in Supplement 2	11.1, 11.4.2

1.8 Confirmatory Issues

The current status of the confirmatory issues follows:

Part A Items

(1) Applicant compliance with the Commission's regulations	Closed in Supplement 2	1.1, 3.1*
(2) Site drainage	Closed in Supplement 1	2.4.3.3
(3) Piping vibration test program	Closed in Supplement 1	3.9.2.1*
(4) Preservice Inspection Program	Closed in Supplement 2	5.2.4, 6.6*
(5) Reactor vessel materials	Closed in Supplement 1	5.3
(6) Electrical distribution system voltage verification	Closed in Supplement 1	8.2.4*
(7) Independence of redundant electrical safety equipment	Closed in Supplement 1	8.4.4
(8) RPM qualifications	Closed in Supplement 1	12.5
(9) Revision to Physical Security Plan	Closed in Supplement 1	13.6

Part B Items

(1) Inservice testing of pumps and valves	Partially closed in Supplement 2	3.9.6
(2) Steam generator tube surveillance	Closed in Supplement 1	5.4.2.2
(3) Charging pump deadheading	Closed in Supplement 1	6.3.2, 7.3.2

*This section includes both site-specific-related information and duplicate plant design features.

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Part B Items (Continued)	Status	Section
(4) Minimum containment pressure analysis for performance capabilities of ECCS	Closed in Supplement 1	6.2.1.5
(5) Containment sump screen	Closed in Supplement 1	6.2.2
(6) Containment leakage testing vent and drain provisions	Closed in Supplement 1	6.2.6
(7) Confirmatory test for sump design	Closed in Supplement 1	6.3.4.1
(8) IE Bulletin 80-06	Closed in Supplement 1	7.3.2.2
(9) Remote shutdown capability	Closed in Supplement 2	7.4.2.2
(10) TMI Action Plan Item II.D.1	Partially closed in Supplement 1	3.9.3.3, 5.2.2
TMI Action Plan Item II.K.3.1	Closed in Supplement 1	7.6.2.7
TMI Action Plan Item III.D.1.1	Closed in Supplement 1	9.3.5
(11) SWS process control program	Closed in Supplement 2	11.4.1
(12) Noble gas monitor	Closed in Supplement 2	11.5.2
(13) RCP rotor seizure and shaft break	Closed in Supplement 1	15.3.6
(14) Anticipated transients without scram (ATWS)	Partially closed in Supplement 2	15.6
(15) Evaluation of compliance with 10 CFR 50.55a(a)(3)	Closed in Supplement 2	5.2.4.4
(16) Steam generator tube failure	Opened in Supplement 1	15.4.3

1.9 License Conditions

The current status of the license conditions follows:

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Part A Items		Status	Section
(1)	Inservice inspection program	Closed in this supplement	5.2.4, 6.6*
(2)	Natural circulation testing	Closed in Supplement 1	5.4.3*
(3)	Response time testing	Closed in Supplement 1	7.2.2.5*
(4)	Steam valve inservice inspection	Closed in Supplement 1	10.2*
(5)	Implementation of secondary water chemistry monitoring and control program as proposed by the Byron/Braidwood FSAR	Closed in Supplement 1	10.3.3*
(6)	TMI Item II.F.1: Iodine/Particulate Sampling	Closed in this supplement	11.5.2
Part B Items			
(1)	Masonry walls	Closed in Supplement 2	3.8.3
(2)	TMI Item II.B.3 postaccident sampling	Closed in Supplement 1	9.3.2
(3)	Fire Protection Program	Open	9.5.1
(4)	Emergency diesel engine auxiliary support systems	Closed in this supplement	9.5.4.1

*This section includes both site-specific-related information and duplicate plant design features.

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3 DESIGN CRITERIA FOR STRUCTURES, SYSTEMS, AND COMPONENTS

3.6 Protection Against Effects Associated with the Postulated Rupture of Piping

3.6.1 Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment

By letter dated May 17, 1985, the licensee informed the staff of revised environmental parameters resulting from a high-energy line break (HELB) in the auxiliary building in either the steam generator blowdown (SD) or auxiliary steam (AS) system. Postulated breaks in these systems have been found to have a greater potential effect on environmental conditions than originally predicted. If a break cannot be isolated within 30 minutes, equipment qualification temperatures can be exceeded.

The licensee further advised in the May 17, 1985 letter that modifications were in progress to install temperature sensors at strategic locations to detect a temperature rise resulting from the local effects of a HELB. A signal from the sensors would initiate automatic closure of an isolation valve in the affected line, thus terminating the break flow. Design, procurement, installation, and testing of the modifications was to be completed by August 31, 1985. As an interim measure for continued plant operation, the licensee committed to post a watch at locations where breaks could occur. In such an event, the watch personnel would communicate with the control room for operator action to immediately close either the SD containment isolation valves or isolate the AS supply line.

The licensee also stated that the modifications had been completed on Byron, Unit 1, and would be completed before fuel loading on Byron, Unit 2, and Braidwood, Units 1 and 2.

The staff evaluation of the adequacy of the modifications to isolate HELBs and prevent auxiliary building temperatures from exceeding equipment qualification temperatures is based on an audit review as prescribed in Standard Review Plan (SRP) Section 3.6.1 (NUREG-0800). It includes a review of the design of the AS and SD systems to ensure conformance with the requirements of GDC 4.

The licensee advised that a temperature of 140°F was the minimum envelope temperature for equipment qualification in the auxiliary building. The modifications for isolating a HELB in the AS and SD systems to prevent environmental temperatures from exceeding 140°F in the auxiliary building consisted of (1) temperature sensors mounted in potentially affected areas (but not too close to the affected equipment), (2) provisions for automatic isolation of the system isolation valves, (3) control room alarms, and (4) appropriate procedures.

The licensee further advised that the temperature sensors and wiring locations in relationship to HELB locations would not be affected by jet impingement. In addition, only Class 1E instrumentation will be used. The staff finds this acceptable.

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Details of the staff's evaluation of HELBs in the auxiliary steam system and the steam generator blowdown system are discussed below.

By letter dated May 20, 1985, the staff accepted the interim measures until August 31, 1985 (when the permanent modifications were to be completed). In addition it was requested that the licensee submit the details of the modifications for staff review.

By letter dated August 2, 1985, the licensee submitted a technical description of the permanent modifications at Byron 1 that would aid in isolating the HELB for the AS or SD systems in the auxiliary building. They also advised that similar modifications, dependent on break location, would be made on Byron Unit 2 and Braidwood, Units 1 and 2, before their fuel loading dates.

By letter dated August 23, 1985, the licensee advised NRC of installation problems resulting from equipment interference and delays in delivery of temperature sensors. A completion date for the modifications was forecast to the Office of Inspection and Enforcement (IE) to be no later than September 30, 1985. By letter dated August 27, 1985, the staff accepted the schedule, provided that personnel would be kept posted at locations where breaks could occur.

By letter dated December 11, 1985, the licensee responded to a staff request for additional information and also advised of additional modifications that were included to accommodate postulated single active failures. A rescheduled completion date for Byron, Unit 1, was set for February 28, 1986.

By letter dated April 29, 1986, the licensee provided the following additional information with regard to the proposed modifications.

Auxiliary Steam (AS) System

Auxiliary boiler steam or main turbine extraction steam is supplied to the AS system. The AS system provides low-pressure steam to various auxiliary building loads that include the boric acid and radwaste systems. A tie line allows for the interconnection of Units 1 and 2.

The licensee has installed redundant temperature sensors in the vicinity of postulated break locations in the auxiliary building where break effects may not be confined to non-safety areas. At a setpoint of 140°F, the sensors will initiate (1) an alarm in the control room and (2) automatic isolation of the AS system from the auxiliary building by closure of the parallel, pressure-regulating valves AS013 and AS167.

To ensure that steam flow is isolated in the event of failure of either of these valves, the licensee stated in a letter dated August 2, 1985 that procedures were being developed to require local manual closure of valve AS012 on receipt of a control room alarm. This valve is positioned upstream and in series with valves AS013 and AS167. By letter dated December 11, 1985, in response to a staff inquiry, the licensee advised that sufficient time for manual operator action may not be available in the event of a single failure of either of valves AS013 or AS167, and stated that further modifications would be made. By letter dated April 29, 1986, the licensee committed to install a redundant automatic isolation valve (AS286) downstream, in series with valves

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AS013 and AS167. The location of the isolation valves ensures that upon a HELB, auxiliary steam from both the affected unit and unaffected unit (via the crosstie) is isolated.

The staff finds that the licensee has provided adequate, redundant isolation valves to ensure isolation of the AS system in the event of a HELB. This will ensure that the temperature in the auxiliary building will not exceed equipment qualification temperatures.

Steam Generator Blowdown (SD) System

The SD system contributes to maintaining proper water chemistry in the steam generators. Each unit's steam generators blow down to a condenser located in the auxiliary building. A crosstie between Units 1 and 2 allows for the blowdown of all steam generators to one blowdown condenser. This may be desired during maintenance of a blowdown condenser.

The licensee has installed redundant temperature sensors in the vicinity of postulated break locations in the auxiliary building where the break may affect safety-related equipment. At a setpoint of 140°F these sensors will initiate (1) an alarm in the control room and (2) automatic isolation of the SD system of the unit with the activated sensors. In response to staff questions by letters dated December 11, 1985 and April 29, 1986, the licensee committed to install redundant automatic isolation valves in each steam generator blowdown line. This will ensure that in the event of a HELB, concurrent with a single active failure, the SD system will be isolated and prevent auxiliary building temperatures from exceeding equipment qualification temperatures.

Automatic isolation of the SD system may not occur, however, if the crosstie between units is being used. For example, in the event of a HELB in one unit, temperature sensors will only initiate isolation of the affected unit's SD system; the unaffected unit's SD system could feed the break via the crosstie. In response to a staff inquiry regarding this, the licensee committed by letter dated April 29, 1986 to revise HELB procedures involving the SD system. Now, on control room annunciation of a 140°F condition, an operator of the affected unit will verify the crosstie valve positions. If the valves are open, operator action will be required at the main control board to close the automatic isolation valves of the unaffected unit's steam generator blowdown lines.

The staff finds that the licensee has provided adequate redundant isolation valves and procedures to ensure isolation of the SD system in the event of a HELB, thus preventing auxiliary building temperatures in excess of equipment qualification temperatures.

From the staff's evaluation of the licensee's plant modifications and procedures, it concludes that the designs of the AS and SD systems for protection against postulated piping failures in the auxiliary building are acceptable, and meet the requirements of General Design Criterion (GDC) 4 with respect to accommodating the effects of postulated pipe ruptures.

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5 REACTOR COOLANT SYSTEM

5.2 Integrity of Reactor Coolant Pressure Boundary

5.2.4 Reactor Coolant Pressure Boundary Inservice Inspection and Testing

5.2.4.3 Evaluation of Compliance with 10 CFR 50.55a(g) for Braidwood Unit 1

By letter dated April 3, 1987, the licensee committed to submit the Braidwood Unit 1 inservice inspection (ISI) program by October 17, 1987. The initial 120-month inspection interval will comply with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code), Section XI, 1983 Edition, including the summer 1983 addenda. This ISI program will be similar to the ISI program established for Byron Unit 1. Therefore, License Condition A(1) is no longer required.

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6 ENGINEERED SAFETY FEATURES

6.4 Control Room Habitability

By letter dated June 3, 1986, the licensee provided an analysis to demonstrate that the chlorine monitors for the control room intake are not required. The analysis included a re-survey of the offsite sources of chlorine within 5 miles of the station, a calculation of the dispersion of the toxic gas and control room infiltration, and a probability evaluation of the rupture of a chlorine tank car on the Norfolk and Western Railroad.

The licensee's analysis stated that the probability of a chlorine tank car rupture within a 5-mile radius of the plant is significantly less than 10^{-6} per year. The licensee's analysis presumed that no toxic gas monitors existed and that the station operator would not don the self-contained breathing apparatus until the chlorine odor was detected (3.5 parts per million (ppm)). The licensee calculated that the concentration existing in the control room 2 minutes after detection would be 13.3 ppm (toxicity is 15.0 ppm). The licensee stated that this allows adequate time for the operators to don self-contained breathing apparatus.

The NRC staff has independently reviewed the probability of a chlorine tank car rupture within the 5-mile radius and calculated the concentration in the control room assuming no toxic gas monitors and detection by odor at 3.5 ppm. The staff's analysis of the probability of a chlorine tank car rupture within 5 miles of the Braidwood facility was 1.3×10^{-6} per year, which was a factor of approximately 30 greater than the probability calculated by the licensee. The reason for this disparity was attributed to the fact that the licensee calculated the probability of an accident based on the frequency of chlorine tank car shipments per year and release per car mile (any type). The calculation should have been based on the probability of a release per chlorine car mile.

The staff's analysis also showed that if the licensee depended on the operators to detect the chlorine at a concentration of 3.5 ppm and then to initiate action to protect themselves, an insufficient period of time existed for the operators to don self-contained breathing apparatus before toxicity limits were exceeded. Consequently, with the absence of chlorine monitors, the staff believes that if a release occurs within 5 miles of the Braidwood facility, the control room should be placed in the isolation mode before chlorine odor is detected by the control room operators. This can be accomplished by early notification of a chlorine tank car accident.

By letter dated December 23, 1986, the licensee indicated that representatives from Will County, Illinois, agreed to provide notification to the Braidwood Station in the event of a chlorine accident. The staff believes that this notification process is an acceptable means of alerting the Braidwood Station so that the control room can be isolated. In addition, the station will be required to include (1) with their control room technical specifications a surveillance requirement to demonstrate on an 18-month basis that the control

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room envelope can be isolated, and (2) a procedure to demonstrate, on an 18-month basis, that control room envelope integrity is maintained (i.e., infiltration into the control room envelope in the isolation mode does not negate the toxic gas analysis and thus, the capability to protect the operators). The first demonstration that the control room envelope integrity is maintained must be completed before the fuel loading date for Braidwood Unit 2.

Although the probability of the occurrence of a chlorine release is small, compensatory actions are in place that would be used to mitigate the consequences of such an event. On the basis of the small probability of a chlorine event, the licensee's commitment to maintain prompt notification communications with the county, the requirement to isolate the control room when notified of a toxic gas incident, and the requirement to demonstrate control room integrity on a routine basis, the staff has determined that the removal of chlorine monitors from the Braidwood Station control room intakes is consistent with the guidelines of SRP Section 6.4 and is, therefore, acceptable. By letters dated April 2, 1987 and May 4, 1987, the licensee committed to demonstrate, on an 18-month basis, that the control room envelope can be isolated and that its integrity is maintained. Therefore, Outstanding Item A(10) is considered closed.

6.5 Fission Product Removal and Control System

6.5.1 Engineered Safety Feature Atmospheric Cleanup System

By letter dated November 17, 1986, the licensee indicated that laboratory analysis of the charcoal to be used in their safety (emergency safety feature) and non-safety grade air filtration units, when tested at 30°C and at 95% relative humidity, demonstrated an average penetration of greater than 1% in nine out of ten batches. The average penetration was 1.5%, which was higher than the maximum of 1% to which the licensee had committed in a letter to the NRC staff dated October 21, 1986. The staff has evaluated this data and has determined that this adsorber material is acceptable. The material has an efficiency greater than that assumed in the safety analysis and, although its efficiency does not reflect the safety factor of seven presented in Regulatory Guide (RG) 1.52, it does reflect a safety factor that is greater than 3. Although the staff considers the use of this charcoal acceptable, the licensee may need to consider purchasing future batches of charcoal that are impregnated with more than just potassium iodide (KI), such as charcoal impregnated by TEDA (triethylenediamine). Such charcoal exhibits greater adsorption capabilities than charcoal impregnated with KI alone.

The licensee also indicated in the letter dated November 17, 1986 that the carbon provided to fill the last six carbon trays and twenty test canisters is not identical to the type of carbon that is in the other trays and, in addition, the American Society for Testing and Materials (ASTM) Standard D-4069 test for carbon properties showed that the carbon is slightly out of specification in that the particle size for the material retained by the #16 sieve is 39% rather than the required 40%. This charcoal, which is impregnated with TEDA and KI, when laboratory tested at 95% relative humidity and 30°C showed a penetration of 0.22% for methyl radioiodine. This TEDA- and KI-impregnated charcoal is approved by the staff for use at the Braidwood facility provided that the TEDA- and KI-impregnated charcoal is not mixed with the charcoal impregnated with KI alone and provided that the test canisters use TEDA- and

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KI-impregnated charcoal if the cells use TEDA- and KI-impregnated charcoal. The test canisters must contain charcoal that represents the type in the ventilation system filter units. The staff does not consider the small difference in particle size distribution as significant in this application. Therefore, use of this charcoal is approved with the conditions noted above.

6.6 Inservice Inspection of Class 2 and 3 Components

6.6.3 Evaluation of Compliance with 10 CFR 50.55a(g) for Braidwood Unit 1

By letter dated April 3, 1987, the licensee committed to submit the Braidwood Unit 1 ISI program by October 17, 1987. The initial 120-month inspection interval will comply with the ASME Code, Section XI, 1983 Edition, including the summer 1983 addenda. This ISI program will be similar to the ISI program established for Byron Unit 1. Therefore, Licensee Condition A(1) is no longer required.

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7 INSTRUMENTATION AND CONTROL

7.6 Interlock Systems Important to Safety

7.6.2 Specific Findings

By letter dated August 2, 1985, the licensee described the design details of a system being installed in Byron Units 1 and 2 and Braidwood Units 1 and 2 to detect and automatically isolate high-energy line breaks (HELBs) in the steam generator blowdown (SD) and auxiliary steam (AS) systems. The intent of the isolation system is to ensure that an HELB in either the SD or AS system will not result in a significant temperature increase in the auxiliary building above the qualification temperatures of safety-related equipment located within the building. Further design information was provided in a letter from the licensee dated April 29, 1986 covering a modification to the isolation system.

The following documents the NRC staff's review and evaluation of the licensee's HELB isolation system based on SRP Section 7.6.

Steam Generator Blowdown System

Each steam generator blowdown line is provided with redundant, series, air-operated isolation valves located in the isolation valve room. The valves, which are held in the open position, close when the plant instrument air supply is removed either by loss of the air source or by de-energization of the solenoid valves. Redundant electrical trains of the HELB isolation function are provided that de-energize the solenoid valves (one solenoid per valve per train).

The HELB isolation signals for the SD system are developed from two temperature switches per train in each of two areas within the auxiliary building. Closure of any of the four temperature switches within a train on a high temperature (approximately 134°F) energizes a corresponding relay that, in turn, de-energizes the four solenoid valves (one per blowdown line) in the train. Annunciation is provided in the control room on closure of any temperature switch. Electrical power for the isolation signals is provided from redundant safety-related sources. Appropriate surveillance and limiting conditions of operation for the system will be included in the technical specifications.

Auxiliary Steam System

The auxiliary steam system line is provided with two parallel-flow, air-operated isolation valves in series with a redundant air-operated isolation valve located in the turbine building. These valves are held open and close when the plant instrument air supply is removed either by loss of the air source or by de-energization of the solenoid valves. Redundant electrical trains of the HELB isolation function are provided that de-energize the solenoid valves (one solenoid for the parallel valves for one train; another solenoid for the series valve for the other train).

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The HELB isolation signals for the AS system are developed from one temperature switch per train in each of six areas within the auxiliary building. Opening of any of the six temperature switches within a train on a high temperature (approximately 134°F) de-energizes a corresponding relay that, in turn, de-energizes the solenoid valve in the train. Annunciation is provided in the control on actuation of any temperature switch. Electrical power for the isolation signals is provided from redundant safety-related sources. Appropriate surveillance and limiting conditions of operation for the isolation system are included in the technical specifications.

SRP Section 7.6 states that "The objectives of the review are to confirm that design considerations such as redundancy, independence, single failures, qualification, bypasses, status indication, and testing are consistent with the design bases of these systems and commensurate with the importance of the safety functions to be performed." Further, the SRP states that specific criteria of the Institute of Electrical and Electronics Engineers (IEEE) Standard 279 are to be used as guidance for systems reviewed under SRP Section 7.6.

The staff's review indicates that the HELB isolation system design satisfies most of the considerations of the criteria in IEEE Std. 279 because it is a redundant, safety-related system comprised of all Class 1E components that are qualified for the appropriate environment. It is automatically initiated when setpoints for the area temperatures are exceeded and there are no control/protection system interactions. The system will be tested as required by the technical specifications. There are no operating or manual bypasses in the system and no multiple setpoints. Once initiated, the system is isolated until system operation is restored by the operator through the use of reset switches. Although there is no manual initiation capability for the system, manual isolation of the SD and AS systems is possible using other solenoids for some of the isolation valves or other isolation valves in the lines. Although valve position indication is not provided in the control room for the isolation valves, flow indication and the annunciation from the temperature switches is available to indicate that the isolation function has occurred. On the basis that the system design satisfies most of the considerations of IEEE Std. 279 as discussed above, the staff finds it acceptable.

Although the staff finds the design acceptable, two deviations from IEEE Std. 279 criteria are apparent. First, one annunciator is provided for each of the systems (AS and SD) isolated. These annunciators are common to the system-related temperature switches and no separate indication at the sensor level is provided. Second, the isolation function is generated effectively by one-out-of-eight (SD system) or one-out-of-twelve (AS system) logic. No provision has been provided to bypass a failed temperature switch or to prevent system isolation during testing. In response to these two issues, the licensee indicated that the information available to the operator on system status is sufficient and that the AS and SD systems would remain in an isolated condition until a failed temperature switch is repaired. The staff finds this acceptable.

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9 AUXILIARY SYSTEMS

9.5 Other Auxiliary Systems

9.5.1 Fire Protection Program

In Braidwood SSER 2, the staff identified three unresolved issues, namely, an incomplete high/low pressure interface analysis of the reactor head vent valves and excess letdown lines, the lack of smoke detectors in the main control console, and a need for revising procedures (PRI-5) to clearly identify those instruments and controls that are electrically isolated from the control room when using transfer switches placed in remote positions. The following discussion addresses the resolution of those three issues. Therefore, Outstanding Item B(6) is considered closed.

9.5.1.2 Fire Protection Program Requirements

By letter dated August 29, 1986, the licensee submitted a proposed revision to FSAR Section 9.5-1. This revision will (1) incorporate the fire protection program that has been approved by the staff, including the fire hazards analysis and commitments that form the basis for the fire protection program, into the FSAR by reference to specific previous submittals, and (2) include a commitment to establish limiting conditions for operation, action statements, and surveillance requirements for the fire protection program within the Braidwood plant operating procedures. The licensee stated that these procedures will provide a level of protection equivalent to that provided by the fire protection sections of the Westinghouse Standard Technical Specifications (NUREG-0452, Rev. 4). Furthermore, in the August 29, 1986 letter, the licensee committed to incorporate this revision to Section 9.5-1 into the Braidwood FSAR by means of a future amendment.

9.5.1.4 General Plant Guidelines

Safe Shutdown Capability

By letters dated September 29, October 23, November 3, and December 12 and 15, 1986, the licensee submitted additional information regarding the high/low pressure interface analysis of the reactor head vent valves and excess letdown lines. In the November 3, 1986 submittal, the licensee proposed to remove power from the reactor head vent valves in the event of a fire (which is stated in the PRI-5-Rev. 54 procedures). The staff finds this consistent with the guidelines of Branch Technical Position (BTP) CMEB 9.5-1, Section C.5.b and, therefore, finds this action acceptable.

By letter dated October 23, 1986, the licensee provided the results of an analysis concerning spurious operation of the valves that form the high/low pressure interface for the excess letdown lines. The licensee has stated that the valves are arranged in such a way that at least four spurious valve failures would have to occur simultaneously to create an uncontrolled coolant loss to the reactor coolant drain tank (RCDT) in the event of a fire. Because of

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the number of valves involved, their simultaneous spurious operation resulting from fire is not deemed credible. Therefore, the design is consistent with the guidelines of BTP CMEB 9.5-1, Section C.5.b. On this basis, the staff finds the licensee's analysis for the excess letdown lines acceptable. This item is, therefore, considered closed.

By letter dated December 12, 1986, the licensee provided additional information concerning clarifications in the PRI-5 procedures. The licensee has stated that those instruments and controls available at the fire hazards panel (FHP 1PL10J) that may be electrically isolated from the control room panels are clearly labeled. Further, the instruments and controls are powered from separate, isolated power supplies. On this basis, the staff finds that the licensee's proposed changes to the PRI-5 procedures are consistent with the guidelines of BTP CMEB 9.5-1, Section C.5.b, and, therefore, are acceptable. This item is considered closed.

By letter dated February 17, 1987, the licensee provided additional information concerning a design change in the power feed to the emergency battery pack lighting units. The problem with the units not turning on in the event of a loss of offsite power is correctable by switching the power feed from the ac (alternating current) essential lighting to non-essential lighting. For Braidwood Unit 1, the battery packs will be installed before reaching initial criticality, and the associated rewiring will be completed before exceeding 5% power. For Braidwood Unit 2, installation of the battery packs and completion of the power feed design change will be completed before fuel loading.

The staff finds that with the proposed power feed design change, the emergency battery pack lighting system design is consistent with the guidelines of Section C.5.g.(2) of BTP CMEB 9.5-1, and is, therefore, acceptable.

In SSER 2, the staff stated that the applicant committed (by letter dated September 22, 1986) to install sprinklers at the hatchway openings on elevations 346, 401, and 426 feet before exceeding 5% of rated power. Additionally, draft curtains were to be added to the hatchways no later than 6 months after fuel loading. However, by letters dated February 17 and March 16, 1987, the licensee notified the staff that 6-inch-thick, removable concrete plugs will be installed at the above hatchway elevations and at elevation 383 feet. The concrete plugs for the hatchway at elevation 426 feet will be completed before 5% rated power for Unit 1. However, the concrete plugs at hatchway elevations 364, 383, and 401 feet will be installed before fuel loading at Braidwood Unit 2 because the hatchways are located on the Unit 2 side of the auxiliary building.

The proposed installation of concrete plugs at the hatchways will provide fire protection equivalent to the sprinklers and draft curtains. Further, the licensee will institute compensatory measures (such as a fire watch) for the hatchways on elevations 364, 383, and 401 feet until the concrete plugs are installed. On the basis of the staff's review and the licensee's commitments, the staff has found the proposed resolution acceptable; therefore, this item is considered closed.

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9.5.1.5 Fire Protection for Plant-Specific Areas

Control Room

Section C.7.b of BTP CMEB 9.5-1 states that smoke detectors should be provided in the control room cabinets and consoles. In Amendment 4 to the Fire Protection Report (FPR), the licensee stated that fire detectors were installed in the main control console, in the vents of the cabinets and at the ceiling of the control room. On this basis, the staff concluded that the smoke detection system for the control room was acceptable. During the fire protection inspection between August 18 and 22, 1986, the staff observed that smoke detectors were not installed in the main control room console. This issue remained open in SSER 2.

By letter dated September 29, 1986, the applicant described the capability of the smoke detection system to detect fires in the main control room console. The console panels are provided with return air ducting from the control room ventilation system that terminates at the top of each panel. Each panel return has at least one duct smoke detector to detect smoke within the panels. This provides discrete annunciation of smoke alarms by panel. The duct smoke detectors are installed in accordance with manufacturer's recommendations with respect to air flow velocity and detector location. There are no physical barriers separating the interiors of each panel that would restrict smoke movement to the return air ducting. The control room ventilation system is powered by an emergency safety feature (ESF) bus to ensure that the ventilation system remains operable and that return air from the panels passes the detectors.

The applicant's method of detecting fires within the main control room consoles provides reasonable assurance of early fire detection. On this basis, the installation of detectors for the main control room consoles as delineated in the applicant's September 29, 1986 letter is an acceptable deviation from Section C.7.b of BTP CMEB 9.5-1.

9.5.4 Emergency Diesel Engine Fuel Oil Storage and Transfer System

9.5.4.1 Emergency Diesel Engine Auxiliary Support Systems (General)

The license for Unit 1 contained a condition that required satisfactory completion of dynamic qualification of the instrumentation and controls on the diesel generator control panel. The concern was discussed in Supplement 1.

By letter dated November 18, 1986, the licensee provided additional information in response to the staff's August 23, 1985 letter.

The basic dynamic qualification of the control panels for Braidwood Units 1 and 2 was established on the basis of similarity with the panel including its instrumentation and other devices at the LaSalle plant. The LaSalle control panel was qualified by actual testing. The staff performed a review of the additional information provided in the November 18, 1986 letter and concluded the following:

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(1) During vibration testing of the panel, acceleration responses were recorded at seven locations where safety-related devices are mounted on the panel. This is satisfactory since a direct response measurement at the device location was obtained vs the excitation at the base of the panel only.

(2) On the basis of the acceleration plots on the LaSalle panel, it is evident that driving frequencies during generator operation are in the 10- to 1000-Hz range, which is significantly beyond seismic input range. Therefore, the margin available at the zero period acceleration for the safe shutdown earthquake is adequate to account for the combined effects of the earthquake and operational vibration.

(3) Similarity between the LaSalle components and Braidwood Units 1 and 2 components was indicated in a component by component listing. That is satisfactory.

(4) By providing the details of methods and results of calculations performed, the licensee has established fatigue endurance of the Braidwood Units 1 and 2 control panels. The fatigue damage potential for the Braidwood Units 1 and 2 panels subjected to a synthetic time history was evaluated by comparing them to the fatigue damage induced by measured time histories for the LaSalle panels (qualified by fatigue testing).

On the basis of the above, the staff concludes that the investigation conducted by the licensee on the dynamic qualifications of its diesel generator control panels, including the instrumentation and control devices, is satisfactory, and there is reasonable assurance that the subject equipment should perform its safety function adequately. Therefore, License Condition B(4) is no longer required.

11 RADIOACTIVE WASTE MANAGEMENT

11.5 Process and Effluent Radiological Monitoring and Sampling Systems

The Unit 1 license contained a condition that the licensee demonstrate that the iodine/particulate sampling system will perform its intended function. This issue was discussed in Supplement 2.

In a letter dated December 29, 1986, the licensee submitted a description of the modifications that were made at Braidwood Station, Units 1 and 2, to demonstrate the capability to sample for gaseous radioiodine in conformance with TMI Action Plan Item II.F.1. This information was submitted to provide the NRC staff sufficient detail to evaluate whether the concerns identified in Supplement 2 had been alleviated.

The licensee replaced its 1/4-inch diameter high-range sample line with a 3/4-inch-diameter heat-traced line that samples under both low and mid/high-range operating conditions. An auxiliary pump skid was added with automatic isokinetic flow control through the use of a flow splitter manifold. This auxiliary pump is automatically started by the radiation monitor's coprocessor and stopped by the high flow sample pump. The flow splitter manifold directs the entire sample to the high flow path during low range radioactivity operation when the high flow sample pump is operating and to the low flow sample path during mid/high range operation when the low flow path sample pump and the auxiliary pump are running.

The staff believes that the use of this high flow sample line (3/4-inch) eliminates the concern expressed in the Region III inspection report enclosed in the July 10, 1984 letter from C. J. Paperiello to C. Reed (Inspection Report 50-454/84-33). However, the NRC has contracted Pacific Northwest Laboratories (PNL) to study the problems associated with obtaining representative samples from these sampling lines. Although the staff finds the present modifications to the Braidwood facility acceptable, additional modifications may be required based on the recommendations of the PNL study. For the present, the licensee's modifications are deemed acceptable. Therefore, License Condition A(6) is no longer required.

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13 CONDUCT OF OPERATIONS

13.3 Emergency Planning

13.3.1 Atomic Safety and Licensing Board Decision on Emergency Planning Issues

The Atomic Safety and Licensing Board hearings on the emergency preparedness contention were conducted on October 29, 1985 and March 11-12, 1986. The hearing record was closed on March 12, 1986, and the Board's Partial Initial Decision on Emergency Planning Issues was issued on May 13, 1987. In this decision the Board stated:

> The Board concludes that with respect to all matters in controversy, the offsite emergency response plan for the Braidwood Station complies with the applicable provisions of 10 CFR § 50.47 and 10 CFR Part 50, Appendix E, and provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency; provided, that Applicant shall include in the next annual revision of its booklet, "Emergency Information - Braidwood" a discussion of (a) the physical characteristics of a radioactive plume; (b) the significance of wind speed and direction in the movement of the plume; (c) the relationship between weather conditions and the selection of optimum evacuation routes, the latter topic to be covered in the section of the booklet dealing with evacuation.

In a May 18, 1987 letter to the NRC, the licensee committed to comply with the Board's instructions within approximately 12 weeks, which is the next scheduled date for the revision and distribution of the licensee's public information booklet.

On the basis of this commitment, the staff finds that the licensee has satisfactorily responded to the Board's requirements with respect to this issue.

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APPENDIX A

CONTINUATION OF CHRONOLOGY OF NRC STAFF RADIOLOGICAL SAFETY REVIEW OF BRAIDWOOD STATION, UNITS 1 AND 2

October 16, 1986	Notice of Hearing-Change issued by the ASLB noting that the evidentiary hearing reconvened in Courtroom #1743 at the Federal Building, 219 South Dearborn Street, Chicago, Ill. 60604. It would continue from day to day during the week.
October 17, 1986	Letter from licensee concerning Final Draft Technical Specification Seismic Instrumentation System.
October 27, 1986	Letter to licensee transmitting 20 copies of NUREG-1002, Supplement No. 2 (Braidwood Station SSER 2).
October 23, 1986	Letter from licensee concerning results of analysis of spurious operation of valves.
October 29, 1986	Letter from licensee concerning environmental qualification of electrical penetrations.
October 30, 1986	Letter from licensee concerning Final Safety Analysis Report (FSAR) update.
November 6, 1986	Order denying licensee's petition for review of an Appeal Board decision (ALAB-817, 22 NRC 470).
November 6, 1986	Letter from licensee concerning emergency diesel generators.
November 7, 1986	Letter from licensee concerning emergency core cooling system operability.
November 7, 1986	Order concerning disclosure of certain investigatory materials related to Order dated July 31, 1986.
November 7, 1986	Protective Order concerning disclosure of certain investigatory materials related to order dated July 31, 1986.
November 17, 1986	Letter from licensee concerning atmospheric cleanup filter units, Regulatory Guides 1.52 and 1.140.
November 19, 1986	Letter from Philip P. Steptoe, Isham, Lincoln & Beale (IL&B), to NRC acknowledging Commission's Protective Order of November 7, 1986.
November 20, 1986	Transcript of hearing held on November 20, 1986 in Chicago, Illinois.

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November 21, 1986	Letter from IL&B concerning Affidavit of Nondisclosure related to Protective Order entered on December 6, 1985.
December 1, 1986	Letter from licensee concerning Initial Test Program.
December 3, 1986	Letter from IL&B concerning Protective Order dated November 7, 1986.
December 9, 1986	Transcript of December 9, 1986 telephone conference with licensee, NRC, and intervenor.
December 11, 1986	Letter from IL&B concerning Protective Order dated November 7, 1986.
December 11, 1986	Letter from licensee concerning Initial Test Program.
December 12, 1986	Letter from licensee concerning Resolution of Fire Protection Program Unresolved Items.
December 17, 1986	Order admitting licensee's Exhibit 188 and closing record.
December 19, 1986	Letter from licensee concerning Revision 14 of the Security Plan.
December 19, 1986	Letter from Business & Professional People for the Public Interest concerning Exhibit 9B.
December 23, 1986	Letter from licensee concerning habitability of control room following postulated accidents involving shipments of chlorine.
December 29, 1986	Letter from licensee concerning plant effluent sampling.
January 5, 1987	Letter from IL&B concerning licensee's motion for extension of page limit for brief.
January 16, 1987	Letter to licensee concerning control room habitability--utilization of charcoal absorber material.
January 22, 1987	Letter from licensee concerning Endorsement No. 12 to facility form policy NF-294.
January 23, 1987	Letter to licensee concerning Generic Letter 83-28, Item 4.5.2 (reactor trip system reliability--online testing).
February 3, 1987	Order granting page limit increase and extensions of time.
February 6, 1987	Letter to licensee concerning high-energy line breaks in the auxiliary steam and steam generator blowdown systems for Byron/Braidwood stations.
February 11, 1987	Letter to licensee concerning reconstitution of a fuel assembly, request for additional information.

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February 11, 1987	Letter from IL&B concerning abstracts for the quality control (QC) inspectors.
February 13, 1987	Letter from IL&B concerning abstracts for October 23, 1986.
February 17, 1987	Letter from licensee concerning Appendix R, Emergency Battery Pack Lighting.
February 18, 1987	Filing of reply brief of licensee, Commonwealth Edison Company.
February 20, 1987	Letter from IL&B concerning abstracts for August 25 and 27 and for November 6, 12, 13, 20, 21, and 26, 1986.
February 25, 1987	Letter from IL&B concerning abstracts for November 18 and 19, 1986.
February 25, 1987	Letter from licensee concerning revisions to FSAR.
February 26, 1987	Letter to licensee concerning 50% load reduction startup test.
March 4, 1987	Letter to licensee concerning removal of control room chlorine monitors.
March 4, 1987	Letter from licensee concerning Application for Amendment to Facility Operating Licenses NPF-37 and NPF-66, Appendix A, Technical Specifications.
March 10, 1987	Letter from IL&B concerning licensee's exhibits.
March 11, 1987	Letter to licensee concerning TMI Action Item II.K.3.31.
March 11, 1987	Letter from IL&B concerning exhibits list.
March 16, 1987	Letter from licensee concerning fire protection program.
March 17, 1987	Letter from licensee concerning emergency diesel generator missile effects.
March 17, 1987	Letter from licensee concerning diesel engine-generator rocker arm failure.
March 20, 1987	Letter from licensee concerning Nuclear Site Property Damage Insurance.
March 23, 1987	Letter from licensee concerning application for amendment regarding reconstitution of a fuel assembly.
March 24, 1987	Letter from licensee concerning application for amendment regarding source range flux instrumentation.
March 25, 1987	Letter from licensee concerning proposed exceptions to FSAR Appendix A, Regulatory Guides 1.52 and 1.140.

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March 26, 1987	Letter from licensee concerning control room ventilation interim operation plant.
March 26, 1987	Letter to licensee concerning performance testing of relief and safety valves.
March 27, 1987	Letter from licensee concerning interim operation of heating, ventilating, and air conditioning (HVAC) systems.
March 30, 1987	Order from Atomic Safety and Licensing Board concerning requesting welding procedure documents.
April 2, 1987	Letter from licensee concerning minor corrections to Technical Specifications.
April 2, 1987	Letter from licensee concerning removal of control room chlorine monitors.
April 2, 1987	Letter from licensee concerning diesel engine-generator rocker arm failure.
April 3, 1987	Letter from licensee concerning inservice inspection (ISI) program.
May 18, 1987	Letter from licensee concerning Atomic Safety and Licensing Board's decision on emergency planning.

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APPENDIX B

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APPENDIX F

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*Reflects reorganization since SER was issued.

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APPENDIX I

ERRATA TO BRAIDWOOD STATION, UNITS 1 AND 2, SAFETY EVALUATION REPORT AND ITS SUPPLEMENTS

Page	Line	Change
Supplement 2		
6-8	22	Delete sentence beginning "The applicant stated that the RHR system...".
9-4	14	Change "a fire-rated Material" to "non-combustible material".
9-4	24	Change "a minimum horizontal separation of approximately 15 feet" to "a minimum horizontal distance of 52 feet".
9-5	29	Delete "including tower fans".
9-6	10	Change "05X162-A, B, C and D" to "OSX162-A, B, C, and D".

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NRC FORM 335 (2-84) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

SEE INSTRUCTIONS ON THE REVERSE

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NUREG-1002
Supplement No. 3

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4. DATE REPORT COMPLETED

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5. AUTHOR(S)

6. DATE REPORT ISSUED

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Office of Nuclear Reactor Regulation
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Washington, D. C. 20555

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November 1983 -
May 1987

12. SUPPLEMENTARY NOTES

Docket No. 50-456 and 50-457

13. ABSTRACT (200 words or less)

In November 1983, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-1002) regarding the application filed by the Commonwealth Edison Company, as applicant and owner, for a license to operate Braidwood Station, Units 1 and 2 (Docket No. 50-456 and 50-457). The first supplement to NUREG-1002 was issued in September 1986; the second supplement to NUREG-1002 was issued in October 1986. This third supplement to NUREG-1002 reports the status of certain items that remain-d unresolved at the time Supplement 2 was published. The facility is located in Reed Township, Will County, Illinois.

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